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The State Livestock Sanitary Board

APHTHOUS FEVER OR FOOT-AND-MOUTH DISEASE

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APHTHOUS FEVER OR FOOT-AND-MOUTH DISEASE.

The present outbreak of Foot-and-Mouth disease or Aphthous Fever in the United States was discovered about October 19th in Southern Michigan and Northern Indiana. From this infected territory the disease has spread to many points in the middle west and practically the whole northeastern section of the United States. It is the most extensive outbreak of Aphthous Fever by far that has ever occurred in North America.

On the 19th day of October, 1914, Dr. John R. Mohler, Assistant Chief of the Bureau of Animal Industry, called our Harrisburg office on the telephone and told us that Foot-and-Mouth Disease had been discovered in the southern part of Michigan and two counties in Indiana. The same day that this information was received the following communication was sent to all licensed veterinarians in Pennsylvania and a large number of cattle dealers and commission men in the State.

"Dear Sir:

I have just been officially advised that an outbreak of Foot-and-Mouth disease (Aphthous Fever) exists in Berrien County, Michigan, and St. Joseph County, Indiana.

Many cattle are shipped from these States into Pennsylvania and it is of the utmost importance for us to be on the lookout for cases of this disease that may have been brought in before the Federal quarantine was established over the infected area.

In case you encounter a condition resembling Foot-and-Mouth disease in cattle that have recently been brought into the State or in cattle that have been exposed to such stock I trust you will advise me immediately.

Very truly yours,

(Signed) C. J. MARSHALL,
State Veterinarian.

On Saturday, October 24, 1914, a case of this disease was discovered in a cow in the Union Stock Yards in Pittsburgh. She was promptly destroyed. The Union Stock Yards were quarantined and nothing was permitted to go forward for any purpose except for immediate slaughter. The outbreak occurred at a most unfortunate time for a large number of shipments were en route to Pittsburgh or had already arrived. There were thousands of cattle, sheep and hogs in the yards at the time the quarantine was placed. The yards were emptied as promptly as possible and the work of cleaning and disinfecting was begun at once.

On the same date that the case was discovered in the Pittsburgh Yards suspicious cases were reported on two farms in Lancaster County in steers that had recently been through the Lancaster Yards from Pittsburgh and Chicago. While the symptoms were not positively characteristic of Foot-and-Mouth Disease at either farm, the symptoms were so suspicious that both herds were placed in quarantine and future developments fully justified the precaution. The diagnosis was established on October 24th by Dr. George Ditewig from the Bureau of Animal Industry and the writer. The Lancaster Stock Yards were visited on the same day. No diseased animals or suspicious cases were found there, but there were about 1,500 head of stock or feeder cattle there at the time, many of which had been received in the week previous from Chicago, Pittsburgh and from other points in the infected territory. About 80 per cent. of the animals in the yard had been sold to local feeders, but had not yet been delivered. It was strongly recommended that the yards be quarantined and nothing permitted to leave the yards except for immediate slaughter. The class of animals handled at Lancaster at this time were not suitable for the block. They were feeding cattle and had been purchased for this purpose. It was thought by some that inasmuch as there was no disease among the animals in the yards, that purchasers should be permitted to take their animals home. But no animals were delivered from this time except for immediate slaughter and a quarantine was placed on the yards on October 25th. In a few days the disease developed in the yards, there were thirty-three well marked cases. Those showing no symptoms or lesions were shipped at

once for immediate slaughter. The thirty-three affected animals were destroyed and buried at the yards and preparation begun at once for cleaning and disinfecting the premises. A conservative estimate shows that about twenty-five thousand head of probably infected feeding cattle were distributed among the farmers of Pennsylvania from the Lancaster stockyards during the three weeks previous to the time of quarantine on the yards.

Within one week of the time the first cases were discovered in Pennsylvania the disease had been recognized on 120 farms in eleven counties. A federal quarantine was placed on the State of Pennsylvania as soon as the first case was discovered and the eleven counties were promptly quarantined by the State of Pennsylvania, and later it was found necessary for the State Livestock Sanitary Board to place a quarantine upon the entire State.

There are about 100 trained agents from the United States Bureau of Animal Industry and the State Livestock Sanitary Board busily engaged in tracing out so far as possible all shipments of cattle, sheep or hogs that had come into Pennsylvania through or from Chicago, Pittsburgh, Buffalo, Lancaster and several other well known shipping points.

The Federal Government and the State of Pennsylvania are sharing equally in the work, expense and responsibility of locating and stamping out the disease. Commission men, drovers, farmers and about 800 local practicing veterinarians in Pennsylvania are furnishing the Federal Government and the State authorities valuable assistance in fighting this extensive outbreak.

In the fall of 1908 at the same season of the year the last previous outbreak occurred in Pennsylvania. With no established precedent and no trained assistants in Pennsylvania this outbreak which was rather widespread and located on 100 different farms in the State was practically stamped out in less than three months, with the assistance of the United States Bureau of Animal Industry. While the present outbreak is much more extensive and more widely distributed we are fortunate in having a precedent to follow and many trained men to handle the work. It is hoped and believed that with the proper

co-operation the present outbreak can be stamped out in a reasonably short period of time. It is extremely important that this should be done.

At the present time many inquiries are being received in reference to the nature, spread and general importance of Aphthous Fever or Foot-and-Mouth disease, and it was considered advisable by the State Livestock Sanitary Board to publish a circular setting forth the important features of this disease, and request all those interested in the live stock industry of this country to assist in every possible way to get rid of the present infection and protect ourselves from future invasions.

The following description of Aphthous Fever was written by the late Dr. Leonard Pearson and printed for distribution December, 1908. As State Veterinarian at the present time I can fully endorse every word of it and would recommend that it be carefully studied by all who are interested. Much better results can be obtained in eradicating it if the nature and importance of the disease are thoroughly understood.

"APHTHOUS FEVER OR FOOT-AND-MOUTH DISEASE is an acute infectious and highly contagious disease affecting cloven-footed animals. It occurs most frequently among cattle, sheep, goats and swine. It has also, in some rare instances, occurred in horses and some observations denote that dogs, cats and even poultry may be affected by it. The large herbivora, as found in zoological gardens—camels, giraffes, deer of all kinds and elephants—are susceptible. The disease is also transmissible to man; such transmission results most frequently in children and from the use of the raw milk of diseased cows. Aphthous fever in man is usually not a dangerous malady but it is recorded that in some outbreaks there have been many deaths.

The disease is an old one but its most extensive destructive outbreaks have occurred during the past two hundred years. The several invasions of European herds and flocks by foot-and-mouth disease have come from the East toward the West, have been very extensive, covering great regions, involving several countries, and have sometimes persisted many years. The invasion of England which began at about the beginning of the

second third of the past century continued nearly fifty years. The German invasion which began in 1888 continued seventeen years. In 1897-1899 more than 1,000,000 animals were attacked in Holland. There was a small outbreak of foot-and-mouth disease in Western Massachusetts and in Eastern New York in 1870, and an outbreak in New England, centered around Boston, in 1902-3. The latter outbreak involved 244 herds in four states and necessitated the destruction of 4,712 animals.

The rate of mortality from foot-and-mouth disease is low but the destruction of values and the losses resulting from it are high. It was estimated in 1875 by Fleming, the great English authority, that the losses to the farmers of England from foot-and-mouth disease then amounted, upon a very conservative basis of appraisal, to 13,000,000 pounds sterling (\$65,000,000). The loss upon each herd attacked by this disease amounts to from 20 per cent. to 50 per cent. of its value. The consideration of this fact in connection with the knowledge that foot-and-mouth disease spreads with such remarkable facility that, if uncontrolled by public measures, it may attack from 25 to 75 per cent. of the herds of a district will give an idea as to the potentialities for harm that accompany outbreaks of this disease and will explain why farmers in countries that have passed through visitations of this plague dread it more than any other scourge of cattle.

In 1871, about 700,000 cattle were attacked by foot-and-mouth disease in England. The average loss on each bovine animal attacked was £3, making the total loss about \$10,000,000. An outbreak of about the same dimensions occurred the same year in France; this outbreak was repressed but a reinfection began in 1893 and continued to increase and spread until 1900, after which it was fought back until 1906 when there was again a considerable increase. During twelve years, up to 1905, 16,000,000 animals were attacked by foot-and-mouth disease in Germany. The losses to German farmers from this cause amounted to well about \$100,000,000 and the cost to the government of measures applied to control the disease was about \$30,000,000. During the past few years, most of the countries of continental Europe, excepting Scandinavia, have had to keep up a constant, difficult and expensive warfare against foot-and-mouth disease.

In a district or a country where foot-and-mouth disease exists there prevails, and must continue, until the disease is eradicated, a state of unrest and uncertainty with relation to all operations affecting livestock. No one can foresee when his herd will be attacked, every animal brought to premises where the disease has existed is liable to develop the disease; any purchase, not only of animals of susceptible species, but of hay, straw, manure or even grain, if in bags that may have been on infected premises, may introduce the contagion. The combined unrest, annoyance and loss that result under such circumstances destroy all security and profit and lead to a great restriction in cattle trade and cattle keeping. Instances are numerous, in other countries, in which owners of pure bred herds have discontinued breeding, and have sold their cattle, as a result of loss and discouragement from this disease.

So long as foot-and-mouth disease prevails in this country, the permanence of our export trade in live cattle and sheep is in jeopardy. Experience shows that English restrictions on such shipments will be continued until the last trace of disease has been eradicated. These restrictions result from the fear of English farmers that their country may become reinfected and that the memorable and terrible losses they have suffered from the ravages of this disease may be repeated. Great Britain has been free from foot-and-mouth disease since 1901.

THE CAUSE OF APHTHOUS FEVER has not yet been isolated but the properties of the virus of the disease have been studied. It is known that this virus may retain its vitality and virulence in a stable or a manure pile for as long as six months, that it will withstand freezing, and that it may be destroyed by disinfectants. Dark, damp places are most suitable for the prolongation of its life. The virus appears, also, to live upon or in the bodies of recovered animals for several months, so that such animals are a source of danger if they are permitted to come into direct or even indirect contact with susceptible animals. Fleming reports a case wherein the virus of aphthous fever retained its virulence for four months in a feeding trough exposed all of this time to the weather. He cites another instance

wherein the virus persisted five months in a hay rack that had been used by diseased cattle, and the infection was carried in this hay rack to cattle on another farm to which it was taken.

THE VIRUS OF APHTHOUS FEVER SPREADS more easily than that of any other known disease of cattle; it is carried most readily and most surely by affected animals, or by animals that have come from infected herds or premises. It may also be carried, and in numerous authenticated instances has been shown to have been carried in hay, straw, grain, manure, stable utensils, blankets, bags, etc., from premises where diseased animals have been. It is also carried upon the hands, boots or clothing of persons who have been on infected premises. Small animals may transport the contagion just in the way it is carried by inanimate objects, so that it is necessary to guard against the spread of infection by dogs, cats, poultry and pigeons. There are numerous examples of the carriage of infection long distances wherein all means of communication excepting by birds have been excluded. Bolz reported in 1904 a case wherein the virus persisted in a manure pile for six months and caused a new outbreak when cows came in contact with the scattered manure. In the past outbreak in Pennsylvania some cows became infected while walking across a railroad unloading platform over which some exposed cattle that later developed foot-and-mouth disease had passed some hours before; these cows were later placed among other cattle and infected those herds.

Calf buyers and cattle dealers who go from farm to farm and from herd to herd have often carried infection, presumably upon their boots or clothing. Such persons may unknowingly come in contact with the disease in its earlier stages or in its later stages and may fail to recognize that the animal is sick and that they are exposed and then may carry the seeds of disease to other premises. During outbreaks of foot-and-mouth disease, visits of perambulating cattle dealers, of castrators and of careless cow doctors are particularly dangerous. There is, however, no danger from the visits of veterinarians who observe certain precautions.

The State Livestock Sanitary Board has issued the following instructions to its agents who are engaged in work on the control of foot-and-mouth disease:

"1. If there is any reason to suspect that any animals are affected with foot-and-mouth disease in a herd that is to be inspected, the veterinarian should wear special clothing provided for this purpose. If, by chance, a veterinarian should come in contact with an animal affected with foot-and-mouth disease when he is not clad as described below, he must at once disinfect his hands, boots and clothing as well as possible and remain away from the vicinity of healthy cattle, sheep, goats or swine until after all of his clothing has been disinfected by fumigation.

"2. Special clothing for use in the examination of animals affected with foot-and-mouth disease consists of a coat with a smooth rubber surface and so long as to come within ten inches of the ground; rubber boots with extension tops to extend up the thighs; rubber gloves and a rubber hat or a cotton cap, which, after use, may be soaked in an antiseptic solution.

"3. In using the special clothing mentioned in paragraph 2, the tops of the boots should be drawn up, the coat should be tightly buttoned and the sleeves should be closed at the bottom over the wrist of the rubber gloves before the veterinarian enters the premises where the infected animals may be. Before entering the premises, it is invariably necessary to provide and have ready for use a solution of bichlorid of mercury, one part to five hundred. After entering the infected premises, the rubber coat must not be unbuttoned (nothing can be taken from the pocket) until after the clothing is disinfected as provided in the paragraph following.

"4. When the veterinarian leaves the building or pen occupied by the affected animal or animals he should first disinfect his rubber gloves and the entire surface of the coat by washing with a sponge and the antiseptic solution. He will have to have help to wash off the back, shoulders and sides of the coat. Special attention should be given to the removal of infectious material that may have lodged on the front of the coat or the sleeves. After the coat has been cleaned, it may be removed, then the

boots should be washed from the top down to and including the soles and heels, after which the hat should be washed or soaked in the antiseptic solution. Lastly, the rubber gloves should be removed and the clothing put away in a suitable case or bag. The whole kit is to be fumigated with formaldehyde at the close of the day's work."

Cattle hides, calf and sheep skins, wool, milk and the carcasses of slaughtered diseased or exposed animals may convey contagion. Infested stock yards and stock cars and the manure they contain are sources of disease.

THE VIRUS MAY BE TAKEN UP by exposed animals through the digestive or respiratory tract, or infection may result from inoculation upon the skin or into the blood stream.

THE PERIOD OF INCUBATION, or the interval between exposure and the occurrence of the first symptoms, is usually from two to five days. This time may, in exceptional cases, be as short as twenty-four hours and it may be as long as twelve days.

THE SYMPTOMS develop in a rather regular manner and so it is possible to divide the disease into stages.

THE FIRST STAGE begins with more or less dullness and inappetence and is accompanied by fever. The temperature may not be more than 103 degrees F., or it may be as high as 105 degrees to 107 degrees F. This stage is characterized, at first, by dryness and warmth of the muzzle, by a dry, hot mouth, evidence of discomfort of the mouth as shown by slow, careful chewing, by some awkwardness in grasping food, and by grinding the teeth. If an effort is made to examine the mouth it is held tightly closed. Very soon, the mouth becomes unduly moist from the increased secretion of both mucous and saliva. As the tenderness and pain increase, the animal works the tongue and cheeks and makes a sucking, clicking or smacking sound. There is considerable accumulation of saliva in the mouth, some collection of froth about the lips and strings of sticky saliva may descend from the mouth. This condition is more striking at a somewhat later period of the disease. It soon becomes apparent that it is painful for the animal to take up food with the tongue

and lips and if hard solid food is taken, as half of an ear of corn, the head is held high and to one or the other side, so that the corn will gravitate to a less sore place in the back of the mouth, where it may be crushed and then swallowed. Not infrequently, such a mouthful will be dropped, after the pain it causes is experienced. Sometimes during this stage or, perhaps, not until a day or two later, there is evidence of soreness of the feet, as shown by a tendency to shift the weight from one foot to another, by a quick tripping or jerking motion or by an inclination to lie down more than is usual. The first stage lasts one, two or three days.

THE SECOND STAGE, or that of eruption, is characterized by the occurrence of vesicles, appearing as water blisters, in and about the mouth, about the feet and upon the teats and udder. For the mouth eruptions, the favorite seats are the following: the ends and margin of the pad; the tip, borders and top of the tongue; the front and face of the pad; the inside of the upper lip; the inside of the lower lip; the borders of the lips; the muzzle; the lower surface and the fraenum of the tongue; the gum and the lower jaw; the inside of the cheeks, and the roof of the mouth. Vesicles may appear about the nostrils.

Vesicles or blisters appear upon the feet between the hoofs, especially at the front of the cleft; about the coronary band; about the base of the supernumerary hoofs and upon the heels. The vesicles upon the teats are more frequently seen about the orifice and may almost cover the teats, and sometimes occur on the skin of the udder. This condition causes much pain. The opening of the teat may be closed by inflammation and swelling resulting from the eruption. Vesicles appear first as small elevations of the superficial layers of the mucous membrane or skin, from $\frac{1}{8}$ to $\frac{1}{2}$ inch in diameter. They are of grayish color. Vesicles may not become larger or they may increase in size to an inch or more in diameter, or several may become confluent and loosen and raise up an area several inches in diameter. Such extremely large blisters occur upon the tongue and muzzle. The vesicles contain at first a clear, straw colored serum which later becomes cloudy. The membrane covering them is thin and it soon breaks. When the vesicles break, the loosened epithelial

or epidermal layer remains for a time attached at the borders, forming a pocket, and, as it tears more, the loose shreds of membrane hang about the borders of the denuded area until these become detached and fall away.

Vesicles usually appear first in the mouth and almost simultaneously, or a few hours or a day later, on the feet and udder. Sometimes the vesiculation is observed in but one location. In cattle, it is the mouth that it is most likely to show lesions, while among sheep and hogs the lesions may be confined to the region of the feet. Vesicles may be few and small or they may be large or numerous. The resulting discomfort and constitutional disturbances are usually in proportion to the extent of the primary eruption. The affected areas are exceedingly sensitive and painful.

As the vesicles form, the fever abates and when the vesicles rupture, the temperature falls nearly or quite to normal. The subsequent course of the disease is free from fever, unless there is very extensive local inflammation. Vesicles rupture very soon after they form, especially in the mouth, where the membrane covering them is softened by moisture and sustains violence from the constant motion of the tongue, cheeks and lips. About the feet and upon the teats, the vesicles last longer. The second stage lasts one to three days.

THE THIRD STAGE, or that of erosion, is characterized by the appearance of raw, denuded surfaces that result from the peeling off of the outer layers of the mucous membrane or skin that have been undermined, loosened and raised up by the fluid within the vesicles. The raw surfaces thus exposed are a bright, rosy red or even scarlet color. They are bounded by a clear cut, abrupt margin and are slightly depressed below the level of the surrounding surface. The surface of the sore is at first smooth; afterwards it is covered by granulations and later by fluid pus or by a more or less tenacious dirty-yellow colored exudate. The surface of the erosion, if upon the cheeks or tongue, may show red, naked papillae denuded of their epithelial covering.

The soreness of the mouth is in some cases sufficient to prevent the animal eating or drinking for several days, perhaps for a week. Under these circumstances, milk flow ceases and emaciation is rapid. If excessively sore feet add to the discom-

fort, constitutional effects are more marked. Pregnant animals may abort. In many instances, the udder becomes inflamed, especially in fresh cows, and may be permanently damaged or ruined. There is often irritation and discharge from the eyes and nose. Many animals cough, revealing irritation of the bronchial mucous membrane or of the throat.

The disagreeable sensation and the pain of the mouth may cause the animal to work the tongue and jaws and to suck and click the cheeks and tongue in such a way as to make a peculiar (but not wholly characteristic) smacking sound. There is frothing about the lips and drooling of saliva.

The effect of this disease upon milk secretion is shown by the following record of the yield of a herd of thirty-two milking cows (some nearly dry) in Montour county, Pennsylvania. An infected bull was brought to this farm October 27th, 1908; the first symptoms among the cows was observed in one animal November 3rd, after which the disease developed rapidly in the herd until all were affected.

Date.	Pounds of Milk.
October 31st,	465
November 1st,	468
" 2nd,	437
" 3rd,	440
" 4th,	430
" 5th,	378
" 6th,	240
" 7th,	168
" 8th,	156
" 9th,	85
" 10th,	62

The third stage lasts from five to ten days, or about a week.

THE FOURTH STAGE is the period of healing. Preliminary to healing, there may be some corrosion and sloughing, during which erosions develop into deep and extensive ulcers. In most cases, however, healing begins rather promptly and continues rapidly. The erosion gradually closes in from the border and becomes smaller and smaller until it disappears. When

healing is taking place the periphery of the sore area is of a gray or yellowish-gray color, and one frequently finds a yellow and rather tough deposit upon the unhealed surface. When this is removed, the base of the sore is found to be of red color.

THE AFTER EFFECTS OF FOOT-AND-MOUTH disease are sometimes very marked and of long duration. Dr. Salmon has reported that during the outbreak of 1902-1903 in New England a few herds that had passed through the disease were left. In about one-third of these cases the owners afterwards asked to have their cattle destroyed, as the cattle were unprofitable or relapses had occurred. Herds that have passed through foot-and-mouth disease are frequently left in an unthrifty, debilitated condition. This is especially true of dairy herds. Young cattle, dry cows and steers are less severely affected.

There is a malignant form of foot-and-mouth disease in which the mortality is high. Outbreaks of this type of disease, in which from ten to fifty per cent. of the attacked animals died, have been reported from several foreign countries. Complications following foot-and-mouth disease are numerous; they consist of abscess formations about the feet, sloughing of the hoofs, abscesses of the udder, garget, gastro-intestinal catarrh and blood poisoning.

When infected herds are not destroyed but are kept, the premises remain infected for a considerable time and it is impossible to disinfect the premises as long as the live animals remain as these animals may continue to distribute the seeds of the disease and may ré-infect the clean premises a long time after the symptoms of foot-and-mouth disease have disappeared. An attack of foot-and-mouth disease does not necessarily confer lasting immunity. The increased resistance to infection that follows an attack may continue for one to two years or longer, but it may not endure more than six months, and instances have been recorded wherein animals have passed through two, three, four and even five attacks of foot-and-mouth disease. Some animals have contracted the disease a second time within two months.

- **THE DIAGNOSIS** of foot-and-mouth disease is not a difficult matter where the disease is discovered in its earlier stages in a herd of animals. When one animal is affected or where the dis-

ease has reached a late stage of development there is often difficulty in distinguishing foot-and-mouth disease from some other condition. There is also difficulty with relation to shipped and market animals brought together in large numbers.

The conditions that are most likely to give rise to error are those due to accidental injuries to the mucous membrane of the mouth and a form of inflammation of the mouth caused by fungi, known as mykotic stomatitis.

Wounds, or external injuries of the mouth, are sometimes seen as ulcers upon the edge of the pad opposite the lower incisors. These may be of the shape of the edge of the incisors and manifestly are toothcuts. Such tooth-cuts may become infected, causing a small ulcer of irregular shape, and sometimes from such a wound there is a cross infection to the inside of the upper lip. Injuries to the tongue, gums or roof of the mouth may be caused by hard, rough objects taken in with the food. Such injuries usually appear as cuts, tears or scratches and not as flat erosions.

From close grazing, especially on a stubble field, cattle may wound the muzzle and lips, or the lining mucous membrane of the lips. Such wounds show as scratches or punctures, or as rough, abraded surfaces; they do not have the appearance of erosions and do not have the bright, red color that is characteristic of the lesions of foot-and-mouth disease.

There is another form of injury that requires special mention. Cattle shipped by rail and that have been in the cars for a long time, with little or insufficient food and water, have a tendency to lick and to gnaw the wood work of the car. From this they may sustain injury to the inside of the upper lip and the mucous membrane covering the front of the upper jaw. Sometimes the tongue is rubbed. These injuries appear as defects of the mucous membrane of irregular shape and size, brownish color and rough surface. They may be overlaid with brown, thin crusts. In examining such a lesion, it is well to wash it off with water, whereupon it will be found that the surface is stained and discolored and that it is of rough, warty appearance and looks "dead," in contrast with the bright red and "blooming" lesion of foot-and-mouth disease. In such cases the mucous membrane of the mouth is likely to be pale and there is little if any salivation, in contra-distinction to the injection of the mucous mem-

brane and excessive moisture in foot-and-mouth disease. It is to be remembered that in foot-and-mouth disease the epithelium is lifted up, leaving a smooth surface below, whereas in these traumatic defects there is a mechanical tearing or a dry mortification, leaving a rough, irregular surface. This form of traumatic stomatitis is not accompanied by any evidence of foot-and-mouth disease upon the feet or udder. One may find, however, in cattle that have been shipped a long distance a certain amount of stiffness and lameness, and if they have been standing long in foul cars or stockyards there may be some irritation between the hoofs.

In mykotic stomatitis, there is no preliminary vesicle formation; a distinct layer, as a false membrane, develops upon the surface of the mucous membrane, and the disease is not contagious, although a large proportion of the animals in a herd may be similarly affected, having been exposed to the same conditions.

One must also distinguish between foot-and-mouth disease and ergotism, foot-rot and foul-claw, and between foot-and-mouth disease and cowpox.

The animal that has passed through an attack of foot-and-mouth disease may be recognized by the presence of unhealed ulcers. These, in their last form, may appear only as small red depressions or as yellow spots. Very slightly depressed areas covered by clean mucous membrane, may be seen upon the dorsum of the tongue. Such spots following erosions of aphthous fever have sharply defined borders and the papillae covering them are more slender, shorter and whiter than upon the surrounding membrane. The spots may be circular and small, or they may be of irregular shape and cover half of the dorsum of the tongue. The healing of an ulcer at the tip of the tongue—a frequent seat—may leave a little puckering of the membrane. Yellowish scars or puckering of mucous membrane about the margin of the pad and within the upper lip may remain from the healing of ulcers of aphthous fever.

The soreness of the feet and slightly excessive moisture between the digits may remain after the mouth lesions have healed. Sometimes, after extensive eruptions about the feet, the hoof horn develops a ridge similar to that seen on the hoof of a horse

that has suffered with laminitis. There may be a partial separation of the horn from the coronary band, especially at the heels.

It is necessary to hold suspected animals in quarantine until doubt can be removed. In some cases information useful in deciding as to vague and indefinite conditions may be obtained by exposing or inoculating a susceptible animal. In Pennsylvania such inoculations are by law prohibited excepting when made by authority of the State Livestock Sanitary Board.

THE PREVENTION OF FOOT-AND-MOUTH DISEASE is a difficult matter on account of the virulence of the disease, the ease with which the contagion may be transported and the vitality of the virus in the bodies of apparently recovered animals and in places that have been contaminated by diseased animals.

In former times, attempts to control the disease were regarded as hopeless and when Aphthous fever appeared in a locality it was the custom of cattle owners to inoculate their animals and put them through the disease as quickly as possible. They simply accepted as inevitable the loss of a large part of the value of the herds and flocks in infected regions.

The methods of prevention that have been practiced have consisted: first, in general restrictions on trade in animals of susceptible species and their products and the products of farms in infested districts, and the quarantine of infected herds and premises until danger shall have disappeared or, second, in the method now being practiced in Pennsylvania, consisting in the destruction of infected herds and the complete eradication, with the greatest attainable promptness, of all known centers of infection.

The method of control by quarantine has been practiced successfully in a number of instances. On the other hand, attempts to control foot-and-mouth disease by this method have often failed. It is exceedingly difficult to quarantine effectually against Aphthous fever, and **to attempt to do so is to take great and unwarranted risks.** It is necessary that such a quarantine shall be exceedingly rigid, that it shall be faithfully observed to the minutest particular, and that it shall be of long duration. Otherwise, it is not effective, or sufficient to prevent the spread of disease. As long as premises are under quarantine on account of

foot-and-mouth disease there can be no feeling of security in the neighborhood, or even in distant places, on account of the remarkable facility with which this disease spreads. For these reasons, and as a result of considerable successful experience in the use of the "stamping-out" method for the control of foot-and-mouth disease, there has developed, in recent years, a strong sentiment in favor of the application of the second method when the distribution of the disease is such as to denote that it may be successfully controlled and eradicated by this means. The "stamping-out" method was applied with complete success and at small cost, in proportion to the value of the work, in New England in 1902-3.

If foot-and-mouth disease has been permitted to become very prevalent in a community, then it is not possible to eradicate it by the stamping out method, and the very long, troublesome and, in many respects, painful and oppressive method of controlling the disease by quarantine must be practiced. This means that the work would drag on and quarantine restrictions would have to be continued for years. The successful application of the stamping out method, even at very large cost, is by far to be preferred.

If the diseased herds are promptly slaughtered and the contaminated premises disinfected, quarantine regulations may be of relatively short duration. On the other hand, if the infected herds are held under quarantine for recovery, the premises they occupy are dangerous and may be a source from which the disease may spread for as long as six months, or perhaps longer, after the recovery of the diseased animals.

THE CHARACTER OF QUARANTINE that is necessary for the control of foot-and-mouth disease is indicated by the following order of quarantine adopted by the Pennsylvania State Livestock Sanitary Board:

"Upon the discovery of foot-and-mouth disease, it is required that a quarantine shall at once be established of the affected animals and of all cattle, sheep, goats and swine that it is believed may have been exposed. Premises or objects occupied or contaminated by affected animals or their products must be

quarantined and premises may be quarantined where there is reason to believe that there may be danger of contamination by foot-and-mouth disease.

"1. Cattle, sheep, goats and swine under quarantine on account of foot-and-mouth disease must be kept absolutely and wholly separate and apart from all other animals, and all other animals must be kept wholly apart from quarantined animals.

"2. The quarantine is extended to animals other than those originally quarantined, if they are permitted to come in contact with quarantined animals or to enter quarantined premises.

"3. Persons caring for animals quarantined on account of foot-and-mouth disease must not, under any circumstances, come in contact, either direct or indirect, with other cattle, sheep, goats or swine.

"4. No animals shall be allowed to run loose or to go free on or near quarantined premises. This regulation covers domesticated animals of all kinds, including dogs, cats and poultry

"5. If there are pigeons on a farm on premises quarantined on account of foot-and-mouth disease the pigeons shall be killed, or they shall be confined on the said quarantined premises until released by authority of an agent of the State Livestock Sanitary Board.

"6. If domesticated animals, dogs, cats, poultry or pigeons are kept at liberty or are allowed to go free so near quarantined animals or premises that they constitute, in the estimation of an agent of the Livestock Sanitary Board, a menace to the efficiency of the quarantine, such animals may be confined and placed under quarantine.

"7. Milk from diseased or exposed cows or milk produced in or on quarantined premises shall be placed in milk cans, or other receptacles that have covers that fit tightly. Formaldehyde shall be added to such milk in the proportion of one pint of formaldehyde (37 to 40 per cent.) to thirty quarts of milk. The covers shall then be placed on the cans or receptacle and the milk and formaldehyde mixture shall remain in the cow stable, undisturbed, for not less than eight hours, after which it is to be poured into a pit dug in the manure pile and covered over with manure. Agents of the State Livestock Sanitary Board may authorize other safe methods for disposing of such milk."

[Section 33, P. L. 928. 57. **Skimmed Milk, Etc., for Animals, to be Pasteurized.** Every owner, operator, or manager of a creamery, cheese factory, receiving station, or skimming station, shall, before returning to or delivering to any person or persons any skimmed milk or separator slop, to be used for food or feeding purposes for calves or swine, cause such skimmed milk to be thoroughly pasteurized by heating it to at least one hundred and seventy-eight degrees Fahrenheit. 1913, July 22; P. L. 928; Sec. 33.]

The present outbreak of Foot-and-Mouth disease was spread extensively in Michigan and Indiana by unpasteurized milk from a creamery. Two similar outbreaks have occurred in Pennsylvania. It is extremely important that this section of the law should be carefully enforced and it is strongly urged that creameries or skimming stations should be equipped with means for properly pasteurizing all by-products before they are allowed to be delivered for food for calves or swine.

A circular was recently sent out by our Board giving instruction in reference to installing an economical but satisfactory system for pasteurizing milk for this purpose.

"8. There shall not be removed from quarantined premises, without specific permission in writing from an authorized representative of the State Livestock Sanitary Board, any material, article or thing that is likely to or that may convey contagion, and, in particular, there shall not be removed from such premises any milk or milk products; diseased, exposed or quarantined animals; hay, straw, fodder, grain or other feed; manure, stable or milk utensils.

"9. Horses that are to be used must be kept in a stable separate from the buildings and premises under quarantine. Before removal to such stable the horses shall be thoroughly cleaned, their feet and legs shall be disinfected and the halters and harness shall be disinfected.

"10. Persons caring for quarantined animals must not convey or permit the conveyance, from the quarantined premises, of articles, materials or things that have been in contact with, that are contaminated by or that may have been contaminated by diseased animals.

"11. All unauthorized persons are forbidden to enter quarantined premises or to come in contact with diseased or exposed animals, or with any object or thing that may have been contaminated by or from such animals."

This quarantine is continued until the affected and exposed animals are killed and the premises disinfected.

In addition to quarantine regulations applying to affected farms, it is necessary to control the shipment of the cattle in and from districts in which foot-and-mouth disease exists, has recently occurred, or is suspected."

IN PENNSYLVANIA the work of suppressing foot-and-mouth disease is carried on in co-operation between the State Livestock Sanitary Board and the Bureau of Animal Industry of the United States Department of Agriculture. Animals that it is necessary to destroy are appraised at full value. One-half of the appraisement is paid by the Federal government and one-half by the State. The cost of burial, of disinfection, and of damages to forage and stables through necessary cleaning and disinfection, are shared by the Federal and State governments.

The following article directing attention to the highly contagious character of foot-and-mouth disease and pointing out why it should be stamped out, was prepared by Dr. Louis A. Klein, of the School of Veterinary Medicine at the University of Pennsylvania:

The alarm and anxiety created among veterinary sanitarians by the appearance of aphthous fever or, as it is more commonly called, foot-and-mouth disease, is due to the highly contagious character of the malady and to the fear that it may escape from control and become permanently established in this country. Usually, it is not a very fatal disease, except among young animals, but it renders dairy cows useless for a considerable time and causes a loss of flesh in meat-producing animals, while the necessary quarantine restrictions seriously interfere with the traffic in livestock and in certain farm products like hay and straw. The loss is often greater than if death occurred at once. In the countries of continental Europe where the disease has gained a foothold, it has been the cause of enormous losses and great inconvenience.

The virus which causes the disease is thrown off by the infected animal in the saliva, which dribbles from the mouth in large quantity; in the discharges from the sores on the feet, in the milk and in the excrement discharged from the body. Stables, stock yards and railroad cars occupied by diseased animals are contaminated with the virus and healthy animals subsequently placed in such places are likely to become infected and may carry the infection great distances on their hair and feet. For instance, in 1908 twenty-one cattle which were subsequently found to be infected with foot-and-mouth disease occupied a pen in the stock yards at Detroit for two hours, during which time they were fed and watered. A lot of bulls which were placed in this pen four days later carried the infection to the Buffalo stock yards, and cattle shipped from the pens occupied by the bulls in the Buffalo yards carried the disease to various points in New York, Pennsylvania and Maryland.

Hay and straw stored in infected premises, litter and manure from places occupied by diseased animals, and hides from infected animals may also carry the infection. Horses, although practically immune to the disease, may carry the virus on their hair and feet. Persons attending to diseased animals may carry the virus on their clothing and hands and subsequently infect other animals with which they come in contact. In the 1908 outbreak of the disease, a man, hearing that his son's cattle had the disease, visited the place and then returned home, a distance of three miles, and cared for his own cow. In a few days this cow developed the disease.

The disease is readily transmitted from one animal to another. If an animal affected with the disease is placed among a lot of healthy ones, one after another of the latter will become infected until all are diseased. In 1908, a farmer had a cow in a pasture in which several cattle from Buffalo had been placed. Six days after the arrival of the cattle from Buffalo, he removed the cow to his own barn. Seven days later all of the cattle on the place, 16 in number, showed symptoms of foot-and-mouth disease.

On account of the highly contagious character of the disease, vigorous measures are necessary to prevent the spread of the infection. Communication with infected premises must be prohibited as far as possible and nothing which may carry the in-

fection can be permitted to be removed from the place until after it has been properly disinfected. Those caring for diseased and exposed animals must be required to wear special clothing and foot-gear for this purpose and to carefully disinfect the hands on leaving the stable. Inspectors clothe themselves entirely in rubber, including rubber boots, gloves and hat, and this clothing is disinfected and fumigated after each inspection. The regulations must be stringent to be effective. Where the number of animals concerned is not so great as to make the expense prohibitive, it has been found most economical to destroy and bury all diseased and exposed animals. This is the most certain method of stamping out the disease and it is also the cheapest in the long run. It has been used with success in Denmark, where it originated, and in England and the United States. In these countries in which the diseased and exposed animals are quarantined until new cases cease to appear, the losses are considerable and continuous and the disease is a constant menace to the live-stock industry. After the animals are disposed of, the premises must be carefully cleaned and disinfected; also all infected fodder and manure. At a time like the present, when it is not certain that all of the infected animals have been located, it is also necessary to prohibit cattle sales and the movement of animals from one farm to another. The removal of hay and straw from farms and the shipment of hides must also be stopped for the time being.

The disease may be transmitted to man through milk and other dairy products. Cases were reported in man and especially in children during the previous outbreaks of the disease in this country. In the present outbreak, the affected animals are very largely steers and hogs and the danger from this source is probably less than in the 1908 outbreak. The danger from this source may be entirely avoided by heating milk at 158° F. for ten minutes or at 176 to 185° F. for an instant. The virus circulates in the blood only during the first day or two, consequently the meat, except the tongue, will be free from the infection except possibly when the animal is slaughtered during the first stages of the disease. No cases of the disease in man which could be traced to the meat have been observed and the danger from this source is very slight.

Cattle are the most susceptible to the disease, next in order come hogs, and then sheep and goats. Symptoms usually appear on the second to the seventh day after infection takes place. The disease begins with a fever, which is often not manifested by any visible symptoms in adult animals. In two or three days, vesicles or blisters appear in the mouth and on the feet, also on the udder of cows, and these subsequently rupture and form ulcers. The most noticeable symptoms are dribbling of saliva and lameness. The mouth symptoms are the most prominent in cattle and the foot symptoms in hogs and sheep.

This is the sixth time the disease has appeared in the United States. The first outbreak occurred in 1870, and the others in 1880, 1884, 1902-3 and 1908. The regulations of the Federal government guard all the known channels through which the disease may enter but in each of the recent outbreaks the disease has come in through some new and unexpected way. The infection in 1908 was imported in smallpox virus and that channel of infection has since been protected, but in the present outbreak the infection appears to have been brought in with some material used in tanning hides, a source never before incriminated. On all previous occasions of its appearance the disease has been stamped out. The outbreak in 1908 was suppressed and all quarantine restrictions removed in less than five months, a record time for such work. In the present outbreak, however, the infection was carried into the Chicago stock yards, the greatest distributing point for cattle and hogs in the country, and the disease is consequently more widely disseminated than ever before.

The work of locating, quarantining and disposing of herds affected with foot-and-mouth disease is progressing rapidly at the present time. The first work that is being done is to trace all the shipments possible that have been received in Pennsylvania from Chicago, Pittsburgh and the west and distributed among feeders since August 1st. After this work has been completed it will be necessary to make a farm to farm canvass of all the dairies in the infected territory and examine each individual animal in a herd for any evidence of infection from this disease. At least two such inspections will be necessary and the owners are requested to co-operate with the agents in making this examination.

It is probable that the quarantine will not be lifted on a county or the State until three months after the last case of the disease has been reported. For this reason it is very important that infected animals be reported as promptly as possible.

